

II. Rejections under 35 U.S.C. § 103

The Examiner rejected claims 1-3 and 5 under 35 U.S.C. § 103, as being obvious over EP 0316525 (Fibiger) or U.S. Patent No. 4,872,984 ('984 patent) in view of U.S. Patent No. 5,798,078 ('078 patent). This rejection is respectfully traversed.

The Applicant's invention relates to a composite reverse osmosis membrane comprising a porous support, a polyamide skin layer formed on the support, wherein the contact angle between the polyamide skin layer surface and water is no more than 45°, the salt rejection is at least 98%, and the permeate flow rate is at least 0.5 m³/m²•day when evaluated by using feed water which has pH 6.5, 0.05 weight percent salt, and an operation pressure of 5 kgf/cm² at a temperature of 25°C. *See* Claim 1. Advantageously, the Applicant's invention also has a *sodium chloride* rejection of at least 98%, as supported, for example, by in Example 1 of the present invention.

A. Fibiger and the '078 Patent

The Examiner is correct in asserting that Fibiger discloses a polyamide reverse osmosis composite membrane. However, on page 11, lines 14-16, Fibiger states “[i]t is noteworthy that the sodium chloride rejection of both membranes is much lower than the magnesium sulfate rejection.” Specifically, Fibiger discloses a sodium chloride rejection of 53-62%, in contrast to the Applicant's disclosure of at least 98%. The Applicant can find no disclosure in Fibiger which suggests or shows a salt rejection level of at least 98%, when the salt is sodium chloride. Tables 4 and 9 in Fibiger both include sodium chloride rejection levels which fall short of the Applicant's claimed salt rejection level of 98%. Because Fibiger does not

suggest or show a general salt rejection level of 98%, but is rather limited to magnesium sulfate, Fibiger does not show or suggest the Applicant's claimed range.

Furthermore, the Applicant notes that the measurement results for membrane performance were obtained in Fibiger under a condition of 0.2% NaCl and 225 psi (15.8 kgf/cm³), while measurements were obtained for the present invention, as recited in claim 1, under a condition of 0.05% NaCl and 5 kgf/cm³. A permeate flow rate of a reverse osmosis membrane is proportional to a pressure obtained by subtracting an osmotic pressure from an operating pressure. Therefore, the permeate flow rate described in the present invention under a condition of 0.05% NaCl water and 5 kgf/cm² corresponds to a permeate flow rate of 1.54m³/m²d under the conditions described in Fibiger. In contrast, the highest permeate flow rate disclosed by Fibiger is 1.3 m³/m²d (as shown in Example 13). Therefore, the Applicant respectfully disagrees with the Examiner's assertion that Fibiger discloses a permeate flow rate overlapping the Applicant's claimed range.

In addition, the Examiner states that "it would have been obvious to the skilled artisan at the time the invention was made to have optimized the water contact angle of the polyamide skin layer" This assertion is based on the disclosure of U.S. Patent No. 5,798,078 ('078 patent), which relates to methods of sulfonating polymers. The '078 patent states "the term 'hydrophilic' or 'hydrophilic character' when associated with a material, such as, for example, a polymer or shaped polymer, means that the water contact angle of a droplet of water positioned on the surface of such material is less than 90°." '078 patent, col. 3, lines 4-9.

Notably, the '078 patent contains no teaching or suggestion on how to incorporate this general proposition into a reverse osmosis membrane of the type claimed by the Applicant. The Applicant fails to see how a general statement of a physical property of a class of materials of the type quoted above renders claim 1 obvious. The '078 patent does not show or suggest altering the contact angle of a reverse osmosis membrane to improve salt rejection, as recited in claim 1 of the instant application. Rather, the '078 patent is simply defining the term hydrophilic when associated with a polymer or shaped polymer. Accordingly, the Applicant respectfully disagrees with the Examiner's characterization of claim 1 as merely "discovering the optimum or workable ranges."

Based on the above arguments, the Applicant respectfully asserts that neither Fibiger nor the '078 patent, whether considered individually or in combination, render claim 1 of the instant application obvious. Specifically, Fibiger teaches away from the results claimed by the Applicant and, does not disclose the claimed permeate flow rate, while the '078 patent does not show or suggest modifying the contact angle in order to improve the salt rejection properties of a reverse osmosis membrane. Claims 2, 3, and 5, which depend from claim 1, are likewise patentable.

B. The '984 Patent and the '078 Patent

The '984 patent relates to an interfacially synthesized reverse osmosis membrane useful for the separation of fluid mixtures and solutions. Again, the Applicant respectfully disagrees with the Examiner's assertion that the permeate flow rate disclosed by the '984 patent overlaps the Applicant's claimed permeate flow rate. In particular, the highest permeate flow rate disclosed by the '984 patent is 26.3 gfd (in Example 23), while the Applicant's measurement

conditions correspond to a permeate flow rate of 38 gfd. Furthermore, as discussed above, the '078 patent contains no teaching or suggestion on how to incorporate this general proposition into a reverse osmosis membrane of the type claimed by the Applicant. The Applicant fails to see how a general statement of a physical property of a class of materials of the type quoted above renders claim 1 obvious. The '078 patent does not show or suggest altering the contact angle of a reverse osmosis membrane to improve salt rejection, as recited in claim 1 of the instant application. Rather, the '078 patent is simply defining the term hydrophilic when associated with a polymer or shaped polymer. Accordingly, the Applicant respectfully disagrees with the Examiner's characterization of claim 1 as merely "discovering the optimum or workable ranges."

Based on the above arguments, the Applicant respectfully asserts that neither the '984 patent nor the '078 patent, whether considered individually or in combination, render claim 1 of the instant application obvious. Specifically, the '984 patent does not disclose the claimed permeate flow rate, while the '078 patent does not show or suggest modifying the contact angle in order to improve the salt rejection properties of a reverse osmosis membrane. Claims 2, 3, and 5, which depend from claim 1, are likewise patentable.

VII. Conclusion

The claims have been shown to be allowable over the prior art. Applicant believes that this paper is responsive to each and every ground of rejection cited by the Examiner in the Action dated May 23, 2001, and respectfully requests favorable action in the form of a Notice of Allowance.

Please apply any charges not covered, or any credits, to Deposit Account 50-0591
(Reference No. 04558.039001).

Respectfully submitted,

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